PATENT ABSTRACTS OF JAPAN

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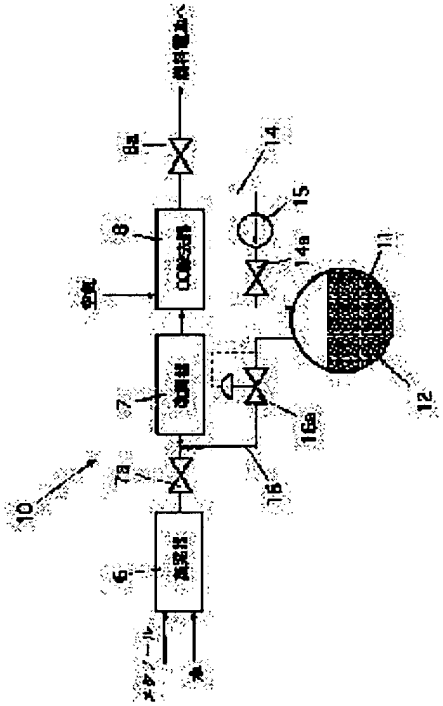
(54) METHOD OF STOPPING REFORMING EQUIPMENT FOR FUEL CELL

(57)Abstract:
PROBLEM TO BE SOLVED: To prevent the lowering of performance of the reforming catalyst due to the condensation of fuel, such as methanol and steam.
SOLUTION: This method of stopping a reforming equipment for fuel cell is provided with an alloy container 12 for storing the hydrogen storage alloy 11 inside thereof, a reforming gas line 14 for leading the reformed gas from a reformer into the alloy container, and a hydrogen gas line 16 for communication the alloy container with an upstream side of the reformer. (a) A part of the reformed gas is introduced to the hydrogen storage alloy via a reformed gas line during the operating of the reformer. (b) Hydrogen is discharged from the hydrogen storage alloy during the stop of the operation of the former, and the hydrogen is supplied to the upstream side of the reformer via the hydrogen gas line so as to purge the fuel and the moisture left in the reformer. (c) The reformer has hydrogen sealed in.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] Have the following and some reformed gas is led to a hydrogen storing metal alloy through a reforming gas line on stream [(a) reforming machine]. Make a hydrogen storing metal alloy absorb only hydrogen, and hydrogen is made to emit from a hydrogen storing metal alloy at the time of a halt of (b) reforming machine. The halt method of the reforming facility for fuel cells characterized by what supply hydrogen to the upstream of a reforming machine through a hydrogen gas line, purge the remains fuel and the moisture in a reforming machine, it (c) Ranks second, and hydrogen is enclosed for in a reforming machine. The alloy container which holds a hydrogen storing metal alloy (11) inside (12) The reforming gas line which leads the reformed gas from a reforming machine in this alloy container (14) The hydrogen gas line which opens the upstream of an alloy container and a reforming machine for free passage (16)
[Claim 2] The halt method of the reforming facility for fuel cells according to claim 1 characterized by what a reforming gas line (14) is equipped with a compressor (15), and the pressure up of the reformed gas is carried out to a predetermined pressure by this, and is supplied to an alloy container (12).

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the halt method of the reforming facility for fuel cells of a solid-state macromolecule type fuel cell etc.
[0002]
[Description of the Prior Art] A solid-state macromolecule type fuel cell (Polymer Electrolyte Fuel Cell:PEFC) has the structure which attached the thin porosity Pt catalyst electrode 2 (an anode and cathode) to the electrolyte at the both sides of this film using the poly membrane 1 which has proton (H+) conductivity, as shown in the principle view of drawing 3 . It is H2 to each electrode. And O2 It is H2, when it supplies and is made to operate before and after a room temperature - 100 degrees C. H2 It is H+ very much (anode). It oxidizes and is H+. It moves in the inside of a film and is O2. It reaches very much (cathode). On the other hand, it is e. - O2 after doing electric work through an external circuit It arrives at a pole. O2 In a pole, it is O2. H+ which reached And it reacts with e- and is returned to H2 O.
[0003] The example of structure of PEFC is shown in drawing 4 . As for PEFC, on both sides of a film / electrolyte zygote 4, one cell is constituted between separator 5. A film / electrolyte zygote 4 arranges the support charge collector 3 which serves as the porous electrode 2 which becomes both sides of ion exchange membrane 1 from Pt black or Pt support carbon from a carbon paper or a carbon cloth. Moreover, separator 5 is a conductive board which has the slot which has the slot which passes gas to both sides, and pours cooling water inside. In addition, the cooling slot on internal joins the separator of two sheets, and consists of examples of drawing 4 .
[0004] A stack (layer built cell) is constituted by carrying out two or more laminatings of a film / the electrolyte zygote 4 to separator 5 by turns. Although the seal of gas or cooling water is performed in many cases on both sides of a rubber sheet or a Teflon sheet in between, the seal of it may be carried out for film itself using the elasticity of ion exchange membrane. Moreover, a metaled collecting electrode plate (not shown) is arranged in the ends of a stack, it considers as an external current drawing terminal, and a clamping plate is further arranged through an electric insulating plate, and the whole is bound tight with a bolt etc. and it unifies. Since it is low-temperature differential 100 degrees C or less, the solid-state macromolecule type fuel cell (PEFC) mentioned above has few heat losses, has the merit which can miniaturize a system and is energetically studied as a portability type power supply to an electric vehicle etc. in each country.
[0005] Drawing 5 is the block diagram of the portable power supply which used the methanol as fuel and combined a methanol reforming facility and PEFC. A methanol reforming facility consists of an evaporator 6, a reforming machine 7, and a CO removal machine 8 in this drawing, and it is a methanol and water to CH3 OH+H2 O->3H2+CO2. A reaction generates hydrogen and a carbon dioxide. This reaction temperature is before and after about 300 degrees C, and heat required for evaporation and the reforming reaction of water and a methanol burns the fuel exhaust gas and air containing hydrogen with an unused fuel cell, and is supplied. This small portable power supply can be used as power supplies for vehicles, such as an electric vehicle.
[0006]
[Problem(s) to be Solved by the Invention] In the reforming facility for fuel cells mentioned above, a gas purge is performed by inert gas in the case of shutdown, and a part for remains fuel and the moisture in a catalyst bed are driven out, and the catalytic activity metal is held to activity reduced condition. This is for condensation of process gas (fuel, such as a methanol, steam) taking place to a reforming catalyst, and reducing the performance of a catalyst or destroying, when it is made to stop as it is, without carrying out a gas purge. Moreover, since a reforming catalyst will be oxidized and the fall of catalytic activity will arise similarly if air mixes, inert gas, such as nitrogen, is used for purge gas.
[0007] However, by carrying inert gas, such as nitrogen, with a bomb etc., when using a fuel cell for vehicles loading,

such as an electric vehicle, when a weight and a space became useless, since there was much number of times of deactivation, there was a trouble which needs to be filled up frequently.
[0008] In order to solve this trouble, the "shutdown method of a methanol reformer" (JP,3-247501,A) which purges an unreacted methanol with high-pressure reformed gas is proposed. However, by this method, although degradation of the catalyst by condensation of a remains methanol could be prevented, since the remains moisture contained in reformed gas condensed and it adhered to a catalyst front face, the fall of the catalytic activity by this remains moisture has not been prevented.
[0009] this invention is originated in order to solve this trouble. That is, the purpose of this invention is to offer the halt method of the reforming facility for fuel cells which can prevent the degradation of the reforming catalyst by condensation of fuel, such as a methanol, and a steam.
[0010]
[Means for Solving the Problem] The alloy container which holds a hydrogen storing metal alloy (11) inside according to this invention (12), The reforming gas line which leads the reformed gas from a reforming machine in this alloy container (14), It has the hydrogen gas line (16) which opens the upstream of an alloy container and a reforming machine for free passage. (a) Some reformed gas is led to a hydrogen storing metal alloy through a reforming gas line on stream [a reforming machine]. Make a hydrogen storing metal alloy absorb only hydrogen, and hydrogen is made to emit from a hydrogen storing metal alloy at the time of a halt of (b) reforming machine. The halt method of the reforming facility for fuel cells characterized by what supply hydrogen to the upstream of a reforming machine through a hydrogen gas line, purge the remains fuel and the moisture in a reforming machine, it (c) Ranks second, and hydrogen is enclosed for in a reforming machine is offered.
[0011] According to the method of the above-mentioned this invention, on stream [(a) reforming machine], a hydrogen storing metal alloy can be made to be able to absorb only the hydrogen gas in reformed gas alternatively, and it can be held. Moreover, since make hydrogen emit from a hydrogen storing metal alloy at the time of a halt of (b) reforming machine, the remains fuel and the moisture in a reforming machine are purged with this hydrogen gas, it (c) Ranks second and hydrogen is enclosed in a reforming machine, deactivation is frequently repeatable without the supplement from the outside. Moreover, since what is necessary is just to be able to absorb the hydrogen for a purge of a draft by one operation, there may be few hydrogen quantities to be stored to the inside of a hydrogen storing metal alloy, consequently can be made lightweight and compact as compared with a chemical cylinder etc.
[0012] According to the desirable operation gestalt of this invention, a reforming gas line (14) is equipped with a compressor (15), thereby, the pressure up of the reformed gas is carried out to a predetermined pressure, and an alloy container (12) is supplied. Without changing the pressure of the fuel cell equipment containing especially a reforming machine, hydrogen can be made to be able to adsorb by the pressure suitable for the hydrogen storing metal alloy, the pressure of a parenthesis can be lowered, and hydrogen can be made to emit by this method.
[0013]
[Embodiments of the Invention] Hereafter, the desirable operation gestalt of this invention is explained with reference to a drawing. In addition, it is used in each drawing, giving the same sign to a common portion. Drawing 1 is the block diagram of the reforming facility for fuel cells which applies the halt method by this invention. In this drawing, this reforming facility 10 for fuel cells consists of an evaporator 6, a reforming machine 7, and a CO removal machine 8, a methanol and water are evaporated with an evaporator 6, and it is CH3 OH+H2 O->3H2+CO2 with the reforming machine 7. By the reaction, hydrogen and a carbon dioxide are generated and the reformed gas from which CO was removed with CO removal vessel 8 is supplied to a fuel cell. Moreover, the upstream of the reforming machine 7 and the downstream of CO removal machine 8 are equipped with isolation valves 7a and 8a, respectively, and the system from the reforming machine 7 to CO removal machine 8 can be intercepted now at the time of a halt of a reforming machine.
[0014] According to this invention, it has the hydrogen gas line 16 which opens for free passage the reforming gas line 14 which leads the reformed gas from the reforming machine 7 further in the alloy container 12 which holds a hydrogen storing metal alloy 11 inside, and this alloy container 12, and the upstream of the alloy container 12 and the reforming machine 7. In addition, in this example, the reforming gas line 14 is open for free passage in the alloy container 12 from between CO removal machine 8 and isolation-valve 8a, and the hydrogen gas line 16 is opening the alloy container 12 for free passage between the reforming machine 7 and isolation-valve 7a.
[0015] Furthermore, in this example, the reforming gas line 14 is equipped with a compressor 15, the pressure up of the reformed gas is carried out to the predetermined pressure suitable for adsorption of a hydrogen storing metal alloy 11 by this, and the alloy container 12 is supplied. Moreover, between a compressor 15 and the alloy container 12, opening-and-closing valve 14a is prepared, and pressure-regulating-valve 16a is prepared in the hydrogen gas line 16.
[0016] Drawing 2 is the property view of a hydrogen storing metal alloy. In this drawing, a horizontal axis is the

amount of content hydrogen, a vertical axis is an equilibrium-hydrogen pressure, and the curve shows each [when decompressing, after fully carrying out occlusion of the hydrogen to the time (absorption) of going up the hydrogen pressure force at the temperature to which the fully activated sample is received] (discharge) equilibrium pressure force in a time. The flat part from which the equilibrium pressure force becomes fixed to concentration is the so-called plateau, and absorption and discharge of efficient hydrogen can be performed by carrying out a pressure up to the plateau pressure at the time of occlusion by the compressor 15 mentioned above, making hydrogen absorb, decompressing by pressure-regulating-valve 16a to the plateau pressure at the time of discharge conversely, and making hydrogen emit. Moreover, this hydrogen storing metal alloy can absorb hydrogen well alternatively, while other various gases and various hydrogen are being mixed (occlusion). Therefore, from the reformed gas in the state where fuel vapor, a steam, hydrogen, CO, etc. were mixed, hydrogen can be absorbed to selection and can be used for a purge at the time of a halt of a reforming machine.

[0017] According to the method of this invention, the reforming facility for fuel cells of composition of having mentioned above is used. (a) Some reformed gas is led through the reforming gas line 14 at a hydrogen storing metal alloy 11 during operation of the reforming machine 7. Make a hydrogen storing metal alloy 11 absorb, and make hydrogen emit from a hydrogen storing metal alloy 11 at the time of a halt of (b) reforming machine 7, and only hydrogen supplies hydrogen to the upstream of the reforming machine 7 through the hydrogen gas line 16, purges the remains fuel and the moisture in a reforming machine, (c) Ranks second, and encloses hydrogen in a reforming machine. According to this method, during operation of (a) reforming machine 7, a hydrogen storing metal alloy 11 can be made to be able to absorb only the hydrogen gas in reformed gas alternatively, and it can be held. Moreover, since make hydrogen emit from a hydrogen storing metal alloy 11 at the time of a halt of (b) reforming machine 7, the remains fuel and the moisture in a reforming machine are purged with this hydrogen gas, it (c) Ranks second and hydrogen is enclosed in a reforming machine, deactivation is frequently repeatable without the supplement from the outside.

[0018] Moreover, since what is necessary is just to be able to absorb the hydrogen for a purge of a draft by one operation, there may be few hydrogen quantities to be stored to the inside of a hydrogen storing metal alloy, consequently can be made lightweight and compact as compared with a chemical cylinder etc. furthermore, the thing for which the reforming gas line 14 is equipped with a compressor 15 -- especially, without changing the pressure of the fuel cell equipment containing a reforming machine, hydrogen can be made to be able to adsorb by the pressure suitable for the hydrogen storing metal alloy, the pressure of a parenthesis can be lowered, and hydrogen can be made to emit

[0019] In addition, of course, it can change variously in the range which this invention is not limited to the operation gestalt mentioned above, and does not deviate from the summary of this invention.

[0020]

[Effect of the Invention] It has the effect to which can make hydrogen able to stick to by the pressure suitable for a hydrogen storing metal alloy, the pressure of a parenthesis can lower, and hydrogen can make emit and which is excellent in **, without changing the pressure of the fuel cell equipment which the halt method of the reforming facility of this invention for fuel cells can especially prevent the degradation of the reforming catalyst by condensation of fuel, such as a methanol, and a steam, and contains a reforming machine, as having mentioned above.

[Translation done.]

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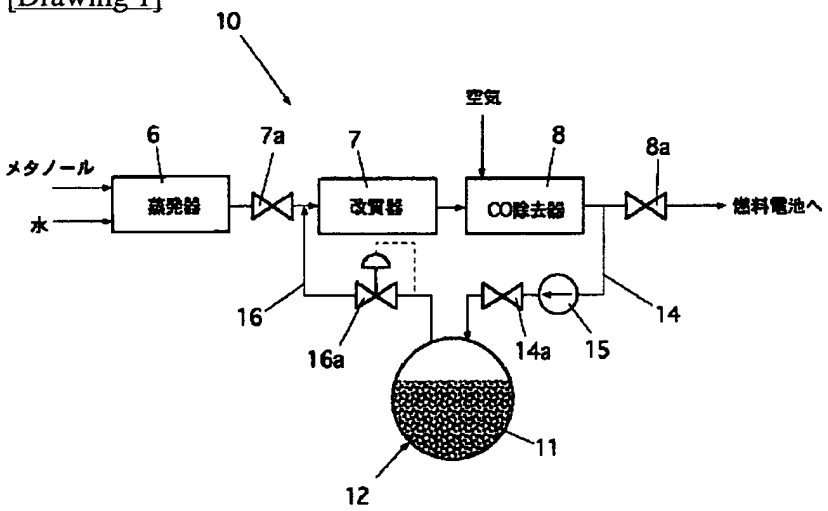
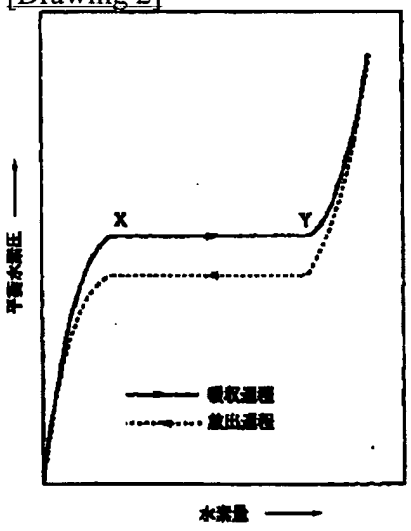
DRAWINGS

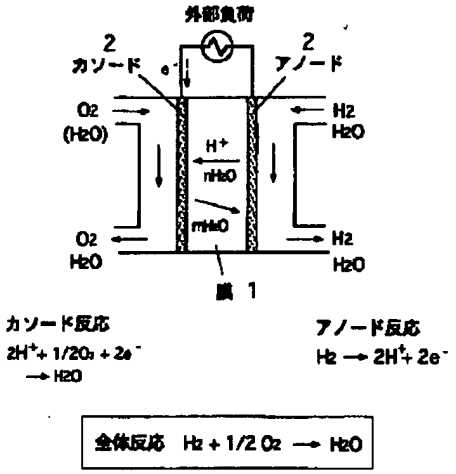
[Drawing 1]



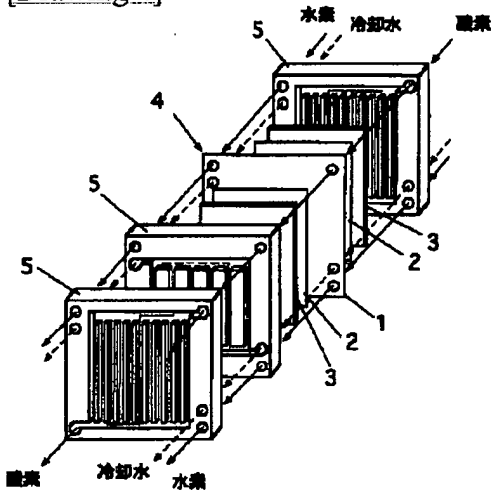
[Drawing 2]



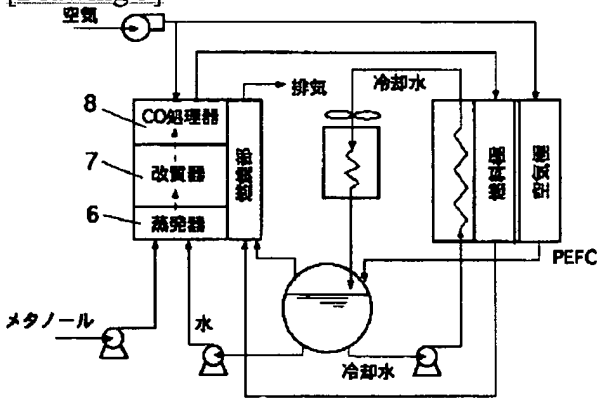
[Drawing 3]



[Drawing 4]



[Drawing 5]



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(19) JAPANESE PATENT OFFICE

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(21) Application number: **10188469**

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(54) **METHOD OF STOPPING REFORMING EQUIPMENT FOR FUEL CELL**

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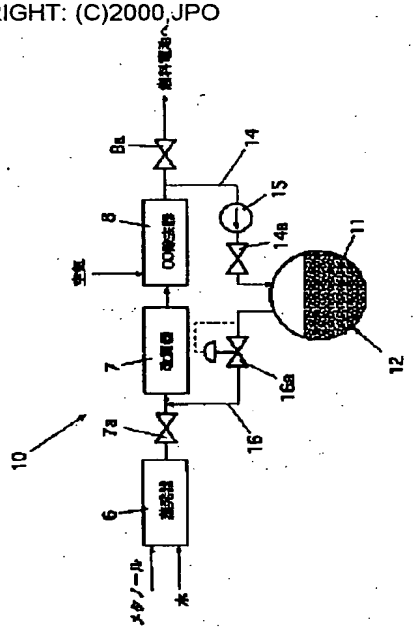
PROBLEM TO BE SOLVED: To prevent the lowering of performance of the reforming catalyst due to the condensation of fuel, such as methanol and steam.

SOLUTION: This method of stopping a reforming equipment for fuel cell is provided with an alloy container 12 for storing the hydrogen storage alloy 11 inside thereof, a reforming gas line 14 for leading the reformed gas from a reformer into the alloy container, and a hydrogen gas line 16 for communication the alloy container with an upstream side of the reformer. (a) A part of the reformed gas is introduced to the hydrogen storage alloy via a reformed gas line during the operating of the reformer. (b) Hydrogen is discharged from the hydrogen storage alloy during the stop of the operation of the former, and the hydrogen is supplied to the upstream side of the reformer via the hydrogen gas line so as to purge the fuel and the moisture left in the reformer. (c) The reformer has hydrogen sealed in.



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審査請求　未請求　請求項の数２　ＯＬ　（全５頁）

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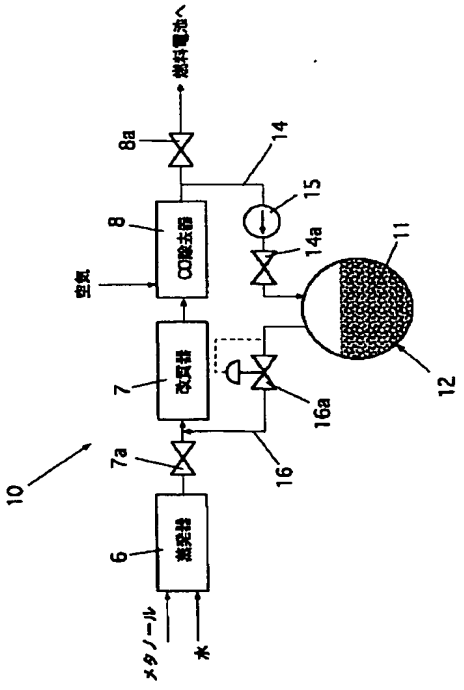
最終頁に続く

(54)【発明の名称】　燃料電池用改質設備の停止方法

(57)【要約】
【課題】　メタノール等の燃料及び水蒸気の凝縮による改質触媒の性能低下を防止することができる燃料電池用改質設備の停止方法を提供する。
【解決手段】　水素吸蔵合金１１を内部に保有する合金容器１２と、合金容器内に改質器からの改質ガスを導く改質ガスライン１４と、合金容器と改質器の上流側とを連通する水素ガスライン１６とを備え、（ａ）改質器の運転中に改質ガスの一部を改質ガスラインを介して水素吸蔵合金に導き、水素のみ水素吸蔵合金に吸収させ、（ｂ）改質器の停止時に水素吸蔵合金から水素を放出させ、水素ガスラインを介して改質器の上流側に水素を供給して改質器内の残留燃料及び水分をパージし、（ｃ）次いで改質器内に水素を封入する。



【特許請求の範囲】
【請求項１】　水素吸蔵合金（１１）を内部に保有する合金容器（１２）と、該合金容器内に改質器からの改質ガスを導く改質ガスライン（１４）と、合金容器と改質器の上流側とを連通する水素ガスライン（１６）とを備え、
（ａ）改質器の運転中に改質ガスの一部を改質ガスラインを介して水素吸蔵合金に導き、水素のみ水素吸蔵合金に吸収させ、
（ｂ）改質器の停止時に水素吸蔵合金から水素を放出させ、水素ガスラインを介して改質器の上流側に水素を供給して改質器内の残留燃料及び水分をパージし、
（ｃ）次いで改質器内に水素を封入する、ことを特徴とする燃料電池用改質設備の停止方法。
【請求項２】　改質ガスライン（１４）に圧縮器（１５）を備え、これにより、改質ガスを所定の圧力に昇圧して合金容器（１２）に供給する、ことを特徴とする請求項１に記載の燃料電池用改質設備の停止方法。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は、固体高分子型燃料電池等の燃料電池用改質設備の停止方法に関する。
【０００２】
【従来の技術】固体高分子型燃料電池（Polymer Electrolyte Fuel Cell:ＰＥＦＣ）は、図３の原理図に示すように、電解質にプロトン（H^+）導電性を有する高分子膜１を用い、この膜の両側に薄い多孔質Ｐｔ触媒電極２（アノードとカソード）を付けた構造を有する。それぞれの電極にH_2 およびO_2 を供給し、室温～１００℃前後で動作させると、H_2 はH_2 極（アノード）でH^+ に酸化され、H^+ は膜内を移動してO_2 極（カソード）に到達する。一方e^- は外部回路を通って電気的な仕事をしたのち、O_2 極に到達する。O_2 極ではO_2 が到達したH^+ およびe^-と反応してH_2Oに還元される。
【０００３】ＰＥＦＣの構造例を図４に示す。ＰＥＦＣは、セパレータ５の間に膜／電解質接合体４を挟んで１つのセルが構成される。膜／電解質接合体４は、イオン交換膜１の両面に、Ｐｔ黒又はＰｔ担持カーボンからなる多孔質電極２と、カーボンペーパあるいはカーボン布からなる支持集電体３を配置したものである。また、セパレータ５は、両面にガスを流す溝を有し、かつ内部に冷却水を流す溝を有する導電性の板である。なお図４の例では内部の冷却溝は２枚のセパレータを接合して構成されている。
【０００４】セパレータ５と膜／電解質接合体４を交互に複数積層することによりスタック（積層電池）が構成される。ガスや冷却水のシールは、ゴムシートやテフロンシートを間に挟んで行うことが多いが、イオン交換膜の弾性を利用して、膜自身でシールする場合もある。また、スタックの両端には金属の集電板（図示せず）を配置して外部電流取出し端子とし、さらに絶縁板を介して締付板を配置し、全体をボルト等で締め付けて一体化する。上述した固体高分子型燃料電池（ＰＥＦＣ）は、１００℃以下の低温差動であるために、放熱損失が少なく、システムがコンパクト化できるメリットがあり、電気自動車等への可搬型電源として各国で精力的に研究されている。
【０００５】図５は、メタノールを燃料とし、メタノール改質設備とＰＥＦＣとを組み合わせた可搬電源の構成図である。この図において、メタノール改質設備は、蒸発器６、改質器７、及びＣＯ除去器８からなり、メタノールと水から、$CH_3OH+H_2O \rightarrow 3H_2+CO_2$ の反応により、水素と二酸化炭素を生成する。この反応温度は約３００℃前後であり、水とメタノールの蒸発及び改質反応に必要な熱は、燃料電池の未利用の水素を含む燃料排ガスおよび空気を燃焼させて供給される。かかる小型可搬電源は、例えば、電気自動車等の車両用電源として用いることができる。
【０００６】
【発明が解決しようとする課題】上述した燃料電池用改質設備では、運転停止の際に不活性ガスでガスパージを行って、触媒層内の残留燃料分や水分を追い出し、かつ触媒活性金属を活性な還元状態に保持している。これはガスパージせずにそのまま停止させた場合、改質触媒にプロセスガス（メタノール等の燃料，水蒸気）の凝縮が起こって触媒の性能を低下させたり破壊してしまうためである。また空気が混入すると改質触媒を酸化させ、同様に触媒活性の低下が生じるので、パージガスには窒素などの不活性ガスが用いられている。
【０００７】しかし、電気自動車等の車両搭載用に燃料電池を用いる場合に、窒素などの不活性ガスをボンベ等で搭載するのでは重量やスペースが無駄になる上、起動停止の回数が多いので頻繁に補充する必要がある問題点があった。
【０００８】この問題点を解決するために、高圧の改質ガスにより未反応のメタノールをパージする「メタノール改質装置のシャットダウン方法」（特開平３－２４７５０１号）が提案されている。しかしこの方法では、残留メタノールの凝縮による触媒の劣化を防止することはできるが、改質ガスに含まれる残留水分が凝縮して触媒表面に付着するため、この残留水分による触媒活性の低下を防止できなかった。
【０００９】本発明はかかる問題点を解決するために創案されたものである。すなわち、本発明の目的は、メタノール等の燃料及び水蒸気の凝縮による改質触媒の性能低下を防止することができる燃料電池用改質設備の停止方法を提供することにある。
【００１０】
【課題を解決するための手段】本発明によれば、水素吸蔵合金（１１）を内部に保有する合金容器（１２）と、

該合金容器内に改質器からの改質ガスを導く改質ガスライン（１４）と、合金容器と改質器の上流側とを連通する水素ガスライン（１６）とを備え、（ａ）改質器の運転中に改質ガスの一部を改質ガスラインを介して水素吸蔵合金に導き、水素のみ水素吸蔵合金に吸収させ、（ｂ）改質器の停止時に水素吸蔵合金から水素を放出させ、水素ガスラインを介して改質器の上流側に水素を供給して改質器内の残留燃料及び水分をパージし、（ｃ）次いで改質器内に水素を封入する、ことを特徴とする燃料電池用改質設備の停止方法が提供される。

【００１１】上記本発明の方法によれば、（ａ）改質器の運転中に改質ガス中の水素ガスのみを選択的に水素吸蔵合金に吸収させて保持することができる。また、（ｂ）改質器の停止時に水素吸蔵合金から水素を放出させ、この水素ガスにより改質器内の残留燃料及び水分をパージし、（ｃ）次いで改質器内に水素を封入するので、外部からの補充なしに起動停止を頻繁に繰り返すことができる。また、１回の運転で１回分のパージ用水素を吸収できればよいので、水素吸蔵合金中への水素貯蔵量は少なくてよく、その結果、ガスボンベ等に比較して軽量、かつコンパクトにすることができる。

【００１２】本発明の好ましい実施形態によれば、改質ガスライン（１４）に圧縮器（１５）を備え、これにより、改質ガスを所定の圧力に昇圧して合金容器（１２）に供給する。この方法により、特に改質器を含む燃料電池装置の圧力を変化させることなく、水素吸蔵合金に適した圧力で水素を吸着させ、かつこの圧力を下げて水素を放出させることができる。

【００１３】

【発明の実施の形態】以下、本発明の好ましい実施形態を図面を参照して説明する。なお、各図において、共通する部分には同一の符号を付して使用する。図１は、本発明による停止方法を適用する燃料電池用改質設備の構成図である。この図において、この燃料電池用改質設備１０は、蒸発器６、改質器７、及びＣＯ除去器８からなり、蒸発器６でメタノール及び水を蒸発させ、改質器７で$CH_3OH+H_2O \rightarrow 3H_2+CO_2$の反応により、水素と二酸化炭素を生成し、ＣＯ除去器８でＣＯを除去した改質ガスを燃料電池に供給するようになっている。また、改質器７の上流側とＣＯ除去器８の下流側にそれぞれ遮断弁７ａ，８ａを備え、改質器の停止時に改質器７からＣＯ除去器８までの系統を遮断できるようになっている。

【００１４】本発明によれば、更に、水素吸蔵合金１１を内部に保有する合金容器１２と、この合金容器１２内に改質器７からの改質ガスを導く改質ガスライン１４と、合金容器１２と改質器７の上流側とを連通する水素ガスライン１６とを備える。なお、この例において、改質ガスライン１４はＣＯ除去器８と遮断弁８ａとの間から合金容器１２に連通し、水素ガスライン１６は改質器７と遮断弁７ａとの間と合金容器１２とを連通している。

【００１５】更に、この例では、改質ガスライン１４に圧縮器１５を備え、これにより、改質ガスを水素吸蔵合金１１の吸着に適した所定の圧力に昇圧して合金容器１２に供給するようになっている。また、圧縮器１５と合金容器１２との間には開閉弁１４ａが設けられ、水素ガスライン１６には圧力調節弁１６ａが設けられている。

【００１６】図２は、水素吸蔵合金の特性図である。この図において、横軸は含有水素量、縦軸は平衡水素圧力であり、曲線は十分に活性化した試料に対してある温度で水素圧力を上昇していったとき（吸収）と十分に水素を吸蔵させた後に減圧していったとき（放出）の各時点での平衡圧力を示している。濃度に対して平衡圧力が一定となる平坦部がいわゆるプラトーであり、上述した圧縮器１５により吸蔵時のプラトー圧力まで昇圧して水素を吸収させ、逆に放出時のプラトー圧力まで圧力調節弁１６ａで減圧して水素を放出させることにより、効率的な水素の吸収・放出ができる。また、この水素吸蔵合金は、他の種々の気体と水素が混合しているとき、水素を選択的によく吸収（吸蔵）することができる。従って、燃料蒸気、水蒸気、水素、ＣＯ等が混合した状態の改質ガスから、水素を選択に吸収して、改質器の停止時にパージ用に用いることができる。

【００１７】本発明の方法によれば、上述した構成の燃料電池用改質設備を用い、（ａ）改質器７の運転中に改質ガスの一部を改質ガスライン１４を介して水素吸蔵合金１１に導き、水素のみ水素吸蔵合金１１に吸収させ、（ｂ）改質器７の停止時に水素吸蔵合金１１から水素を放出させ、水素ガスライン１６を介して改質器７の上流側に水素を供給して改質器内の残留燃料及び水分をパージし、（ｃ）次いで改質器内に水素を封入する。この方法によれば、（ａ）改質器７の運転中に改質ガス中の水素ガスのみを選択的に水素吸蔵合金１１に吸収させて保持することができる。また、（ｂ）改質器７の停止時に水素吸蔵合金１１から水素を放出させ、この水素ガスにより改質器内の残留燃料及び水分をパージし、（ｃ）次いで改質器内に水素を封入するので、外部からの補充なしに起動停止を頻繁に繰り返すことができる。

【００１８】また、１回の運転で１回分のパージ用水素を吸収できればよいので、水素吸蔵合金中への水素貯蔵量は少なくてよく、その結果、ガスボンベ等に比較して軽量、かつコンパクトにすることができる。更に、改質ガスライン１４に圧縮器１５を備えることにより、特に改質器を含む燃料電池装置の圧力を変化させることなく、水素吸蔵合金に適した圧力で水素を吸着させ、かつこの圧力を下げて水素を放出させることができる。

【００１９】なお、本発明は上述した実施形態に限定されず、本発明の要旨を逸脱しない範囲で種々変更できることは勿論である。

【0020】

【発明の効果】上述したように、本発明の燃料電池用改質設備の停止方法は、メタノール等の燃料及び水蒸気の凝縮による改質触媒の性能低下を防止することができ、かつ特に改質器を含む燃料電池装置の圧力を変化させることなく、水素吸蔵合金に適した圧力で水素を吸着させ、かつこの圧力を下げて水素を放出させることができる、等の優れた効果を有する。

【図面の簡単な説明】

【図1】本発明による停止方法を適用する燃料電池用改質器の構成図である。

【図2】水素吸蔵合金の特性図である。

【図3】固体高分子型燃料電池の原理図である。

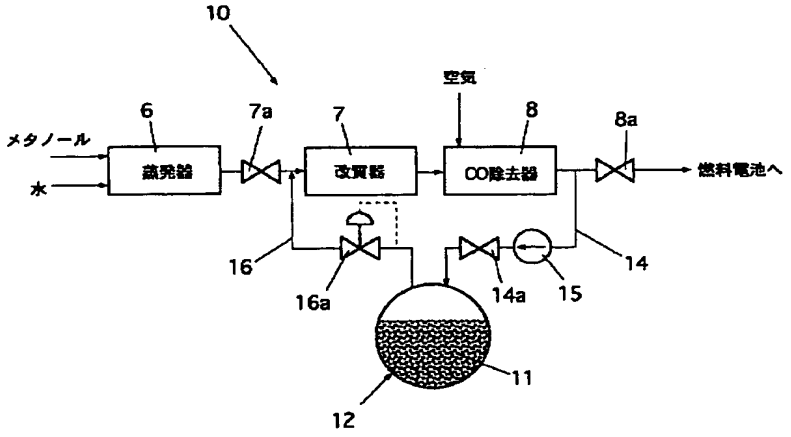
【図4】固体高分子型燃料電池の構造図である。

【図5】従来の固体高分子型燃料電池発電設備の全体構成図である。

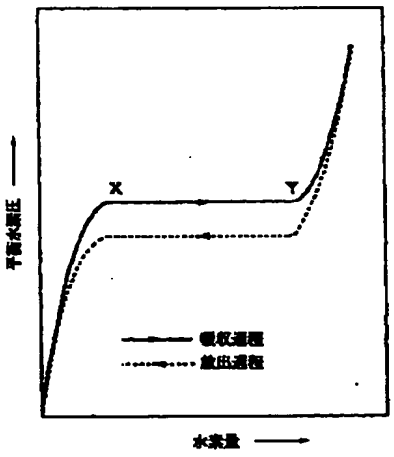
【符号の説明】

1　イオン交換膜（高分子膜）
2　電極
3　支持集電体
4　膜／電解質接合体
5　セパレータ
6　蒸発器
7　改質器
7a　遮断弁
8　CO除去器
8a　遮断弁
11　水素吸蔵合金
12　合金容器
14　改質ガスライン
14a　開閉弁
15　圧縮器
16　水素ガスライン
16a　圧力調節弁

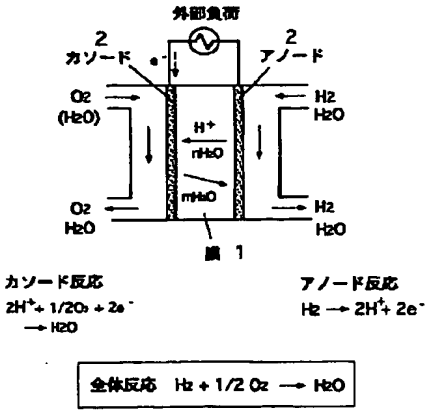
【図1】



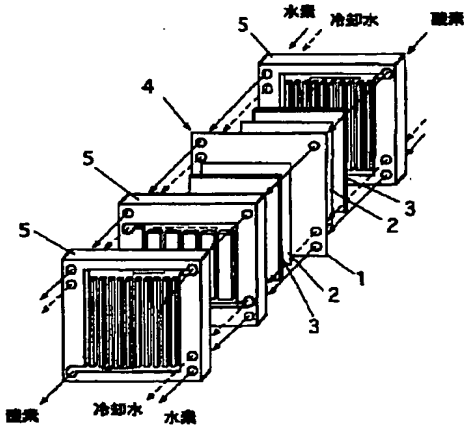
【図2】



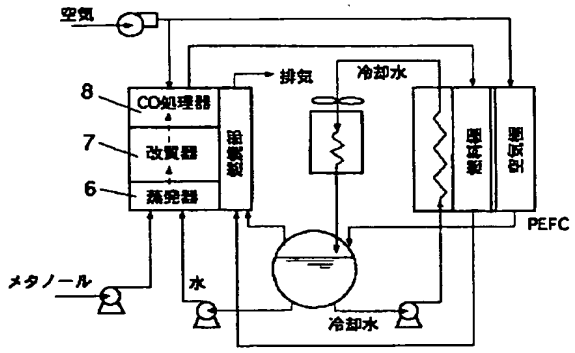
【図3】



【図4】



【図５】



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